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BACHELOR PROJECT TESTING RESULTS DOCUMENTATION

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Chapter 1

Introduction

The purpose of this document is to present the results of testing DFI. It builds upon the test specification set up in the Requirement & testing specification documentation [1], and follows the testing specifications set specified.

1.1 Acceptance of Test Cases

In order for a test case to be considered accepted, the result of the test case must match the expected result. Each test case will be marked with one of the following expressions:

- **Passed**
A ✓ will represent passed. It means the test case is accepted.
- **Passed w/ remarks**
A (✓) will represent passed with remarks. It means the test case is partially accepted but with certain remarks. These remarks will be explained in detail in the 'Comments' column.
- **Failed**
A ÷ will represent failed. It means the test case is not accepted.

1.2 Preparation prior to testing

Prior to testing, the following was set up:

- The physical set-up was as described in the requirement document.
- All physical components were turned on.
- The sediment samples were distributed manually across the tray.
- All programs were installed on the PC device and were able to start.

With the preparation, the testing was conducted.

Chapter 2

Results of testing

This chapter will present the results of testing performed on the DFI system.

2.1 Functional requirements

Functionality requirements			
No.	Expected result	Conclusion	Comments and remarks
1	The motors controls the movement of the microscope.	✓	
2	The motors must move the microscope systematically over the samples, with slight image overlap, such that it doesn't miss any potential Foraminifera.	✓	It moves systematically, in a controlled manner, as described in the Architecture and implementation document [1].
3	The camera must stand still for a fixed amount of time, depending on the exposure time, providing the microscope enough time to grab an image that is in focus.	(✓)	The time it not depending on the exposure time. It does, however, stay still for a fixed amount of time. Therefore it is passed with remarks.
4	The system must be deployable on a PC on which Windows 11 is installed.	✓	
5	The images should be stored on the host PC, so that the user may access and review them manually.	✓	

Table 2.1: Testing specification of functionalities defined in the requirement document.

2.1.1 UC1 testing result

Use case 1: Set settings				
No.	Action	Expected result	Result	Comment
1	User starts up the 'Settings' program.	The setting program starts and a live feed from the camera becomes present, along with a UI guiding the user.	(✓)	No live feed is presented. Instead, it provides the ability to see a sample image. Therefore, it passed with remarks.
2	The user sets a setting with an input	The setting will be set to the provided input	(✓)	Only exposure time can be changed. Therefore, it passed with remarks.

Table 2.2: Testing specification of use case 1

Use case 1 extension 1.1				
No.	Action	Expected result	Conclusion	Comment
1	The user quits the program.	The program terminates with variables keeping their prior values.	✓	

Table 2.3: Testing specification of use case 1 extension 1.1

Use case 1 extension 1.2				
No.	Action	Expected result	Conclusion	Comment
1	The camera is not connected via a viable USB port.	The program displays a warning to the user, recommending to restart the program and check the camera connection.	✓	

Table 2.4: Testing specification of use case 1 extension 1.2

Use case 1 extension 1.3				
No.	Action	Expected result	Conclusion	Comment
1	The provided values exceeds the allowed limit	A warning displays that the value exceed limits. The value of the variable will not be changed.	✓	

Table 2.5: Testing specification of use case 1 extension 1.3

2.1.2 UC2 testing result

Use case 2: Scan samples				
No.	Action	Expected result	Conclusion	Comment
1	The user starts the program.	The program will start, providing the user the option to start scanning.	✓	
3	The system performs the grabbing of images.	Images of the tray are acquired in a systematic manner and stored in a local directory.	✓	

Table 2.6: Testing specification of use case 2

Use case 2 extension 2.1				
No.	Action	Expected result	Conclusion	Comment
1	The camera is not connected via a viable USB port.	The program displays a warning to the user, recommending to restart the program and check the camera connection.	✓	

Table 2.7: Testing specification of use case 2 extension 2.1

Use case 2 extension 2.2				
No.	Action	Expected result	Conclusion	Comment
1	The controller is not connected via a viable USB port.	The program displays a warning to the user, recommending to restart the program and check the controller connection.	✓	

Table 2.8: Testing specification of use case 2 extension 2.2

2.1.3 UC3 testing result

Use case 3: Stitch images				
No.	Action	Expected result	Conclusion	Comment
1	User starts up the Stitching program.	The program will start, asking the user to provide a directory.	(✓)	You have to change the directories within the code itself. Other than that, the program initializes as intended. It therefore passed with remarks.
2	User provides a directory and starts the stitching process.	The images in the provided directory are stitched together to one large image.	(✓)	A test on a full acquisition data-set could not be performed, as no available computer has enough processing power or memory to perform the stitching. The amount of time also greatly depends on the number of images. A successful test was performed on 25 images, where it took about 15 minutes. This means it's doable, but it is not yet sufficient to mark it as passed.

Table 2.9: Testing specification of use case 3

Use case 3 extension 3.1				
No.	Action	Expected result	Conclusion	Comment
1	The images cannot be stitched together	A warning message appears, telling the user the images could not be stitched together.	✓	

Table 2.10: Testing specification of use case 3 extension 3.1

2.1.4 UC4 testing result

Use case 4: Segmentation				
No.	Action	Expected result	Conclusion	Comment
1	User starts up the Segmentation program.	The program will start, asking the user to provide a directory.	(✓)	The directory has to be changed inside the code itself.

2	User provides a directory and starts the segmentation process.	A directory will be created, in which all segmented objects are stored in their own image.	✓	
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Table 2.11: Testing specification of use case 4

Use case 4 extension 4.1				
No.	Action	Expected result	Conclusion	Comment
1	No objects are found on the image.	A warning message appears, telling the user no objects could be found.	(✓)	The system will process any image the same regardless of elements. An output of no images will mean that there are no foreground elements. Essentially just an image of the background tray or the image settings in the acquisition stage were adjusted incorrectly.

Table 2.12: Testing specification of use case 4 extension 4.1

2.1.5 UC5 testing result

Use case 5: Classification				
No.	Action	Expected result	Conclusion	Comment
1	User starts up the Classification program.	The program will start, asking the user to provide a directory.	(✓)	You have to change the directory inside the code. Other than that, the program runs as intended. Thus, passed with remarks.
2	User provides a directory and starts the classification process.	A directory, which contains sub-directories for the groups of classes, will be created. Objects will be stored in a respective folder, depending on what they're classified as.	✓	

Table 2.13: Testing specification of use case 5

Use case testing summary

UC No.	Results	Comments
UC1	(✓)	The only changeable parameter is the exposure time and no live view feed. Instead, it's possible to get a sample image. This considered, it passed with remarks.
UC2	✓	It acquires the images as intended.
UC3	÷	A test on a full acquisition data-set could not be performed, as no available computer has enough processing power to perform the stitching. The amount of time also greatly depends on the number of images. A test was performed on 25 images, where it took about 15 minutes. This means it's doable, but it is not yet sufficient to mark it as passed.
UC4	✓	
UC5	✓	The classification is not perfect, but above the standard set by the non-functional requirements, meaning it can be marked as passed.

Table 2.14: Summary of use case testing.

2.2 Non-Functional requirements

Use case testing summary				
ID	Requirement	Testing	Result	Comments
NF01	Acquiring images of the whole tray must finish within a time-frame of 1 hour 30 minutes	The acquiring program will be timed.	(✓)	On two different tests it grabbed all the images in about 1 hour and 30 minutes.
NF02	The stitching of images must be done within a time-frame of 2 hours	The stitching program will be timed.	÷	A test on a full acquisition data-set could not be performed, as no available computer has enough processing power to perform the stitching. The amount of time also greatly depends on the number of images. A test was performed on 25 images, where it took about 15 minutes.
NF03	The segmentation of an image must be done within a time-frame of 2 hours	The segmentation program will be timed.	(✓)	The stitching works as intended and has been completed within 2 hours for some tests. However, the process is slow and it can not be guaranteed that it will complete within 2 hours if the provided sample is too large.

NF04	The classification of images must be done within a time-frame of 2 hours	The classification program will be timed.	÷	As no data of the whole tray was acquired, this could not be tested. It took about 0.27 seconds per classification.
NF05	The classification must have an f1-score of over 85%.	The model will be tested in a test-set of data.	✓	

Table 2.15: Summary of use case testing.

Bibliography

- [1] L. K. Vindbjerg and D. C. Børrieth. “Requirement and testing document.” (2022), [Online]. Available: <https://github.com/Biorrieth/Bachelor-project/tree/main/References> (visited on 04/15/2022).